

Appendix A

CURRICULUM VITAE

Name:

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Business Address:

Metabolon, Inc.
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Education:

B.A., Biology, North Texas State University, 1977.
M.S., University of Texas at Dallas, 1980. (Molecular Biology)
Ph.D., University of Texas at Dallas, 1982. (Molecular Biology)

Experience:

April, 2002 to Present. President, Chief Executive Officer, Founder, Board Member, Metabolon, Inc. Metabolon is a start up company developing a powerful metabolomics platform for use in rescuing and developing new drugs. The company uses proprietary software and data handling systems coupled with state-of-the-art mass spectrometry to analyze the repertoire of small molecules in cells, tissues and organs. This information is linked to biochemical pathway maps to facilitate an understanding of how biochemistry is affected in disease states or in response to drug treatment.

October, 1997 to March 1, 2002. Chief Executive Officer, President and Co-Founder of Paradigm Genetics, Inc. Member of Board of Directors. Responsible for all aspects of Paradigm Genetics, including developing the initial business plan, obtaining all rounds of equity financing, establishing the business strategy and developing and executing the business plan. Raised \$105 million in investment capital and took the company public in two years. Initiated and negotiated \$200 million in external partnerships.

October, 1996 to October, 1997. Head, Biotechnology and Genomics Center; Head of Research, Novartis Crop Protection, Inc. (including RTP and Palo Alto facilities); Vice-President, Research, Novartis Crop Protection, Inc. Responsibility for all research projects in Novartis Crop Protection in the US, biotechnology research projects for Novartis Animal Health and genomics and high-throughput DNA sequencing projects for Novartis Pharmaceuticals. Oversight of 150 scientists and 30 administrative and support personnel. Managed a yearly budget of about \$25 million.

October, 1993-October, 1996. Head, Agricultural Biotechnology Research Unit, CIBA-GEIGY Corporation. Vice-President, Biotechnology and Intellectual Property, Ciba Seeds. Member of the Executive Committee of Ciba Seeds, US. Responsibilities for biotechnology research and intellectual property projects for

(Experience, cont'd.)

Corporate Research and Pharmaceuticals. Research unit of about 150 scientist and 30 administrative and support personnel. Managed a yearly research budget of \$22 million.

February, 1991-October, 1993. Research Director, Molecular Genetics Department. Biotechnology Research Unit. CIBA-GEIGY Corporation. Responsibilities for biotechnology-based projects in disease control and marker assisted breeding. Department of up to 58 scientists.

January, 1990-February, 1991. Research Manager. Molecular Genetics Department. Biotechnology Research Unit, CIBA-GEIGY Corporation. Responsibilities for biotechnology-based disease control projects for Seeds and Fungicides Businesses. Department of up to 25 scientists.

June, 1987-December, 1989. Staff Scientist. Biochemistry Department. Biotechnology Research Unit, CIBA-GEIGY Corporation. Project Leader-Induced Resistance. Supervised Up to 10 Scientists.

January, 1985-May, 1987. Sr. Research Scientist Biochemistry Department. Biotechnology Research Unit, CIBA-GEIGY Corporation. Project Leader-Induced Resistance. Supervised up to 5 scientists.

January, 1983-December, 1984. Postdoctoral Fellow with Prof. Charles Weissmann. Institut für Molekularbiologie I. Universität Zürich. Zürich, Switzerland. Topic of study: Regulation of human alpha interferon gene Expression.

May, 1982-January, 1983. Postdoctoral Fellow with Prof. Hans Bremer. University of Texas at Dallas. Topic of study: Regulation of growth in *E. coli*.

Publications:

1. Ryals, J. and H. Bremer. 1982. *relA*-dependent RNA polymerase activity in *Escherichia coli*. J. Bacteriol. 150:168-179.
2. Ryals, J., R.Y. Hsu, M.N. Lipsett, and H. Bremer. 1982. Isolation of single-site *Escherichia coli* mutants deficient in both thiamine and 4-thiouridine synthesis: Identification of a *nuvC* mutant. J. Bacteriol. 151:899-904.
3. Ryals, J., R. Little, and H. Bremer. 1982. Temperature dependence of RNA synthesis parameters in *Escherichia coli*. J. Bacteriol. 151:879-887.
4. Ryals, J., R. Little, and H. Bremer. 1982. Control of rRNA and tRNA synthesis in *Escherichia coli* by guanosine tetraphosphate. J. Bacteriol. 151:1262-1268.
5. Ryals, J., R. Little, and H. Bremer, 1982. Control of RNA synthesis in *Escherichia coli* after a shift to a higher temperature. J. Bacteriol. 151:1425-1432.
6. Little, R., J. Ryals, and H. Bremer. 1983. *rpoB* mutation in *Escherichia coli* alters control of ribosome synthesis by guanosine tetraphosphate. J. Bacteriol. 154:787-792.

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8. Hiscott, J., J. Ryals, P. Dierks, V. Hoffmann, and C. Weissmann, 1984. The expression of human interferon alpha genes. *Phil. Trans. R. Soc. Lond. B.* 307:217-226.
9. Ryals, J., P. Dierks, H. Ragg, and C. Weissmann. 1985. A 46-nucleotide promoter segment from an IFN gene renders an unrelated promoter inducible by virus. *Cell* 41:487-507.
10. Kuhl, D., J. de la Fuente, M., Chaturvedi, S. Parimoo, J. Ryals, F. Meyer, and C. Weissmann. 1987. Reversible silencing of enhancers by sequences derived from the interferon-alpha promoter. *Cell* 50:1057-1069.
11. Bremer, H., E. Baracini, R. Little, and J. Ryals. 1988. Control of RNA synthesis in bacteria. In: *Genetics of Translation: New Approaches*. Eds. M.F. Tuit, M. Picard and M. Bolotin-Fukuhara. NATO-ASI Series H:Cell Biology Volume 14. Springer Press.
12. Payne, G., T.D. Parks, W. Burkhardt, S. Dincher, P. Ahl, J.P. Metraux, and J. Ryals. 1988. Isolation of the genomic clone for pathogenesis-related protein IA from *Nicotiana tabacum* cv. Xanthi.nc. *Plant Molecular Biology* 11:89-94.
13. Payne, G., W. Middlesteadt, S. Williams, N. Desai, T.D. Parks, S. Dincher, M. Carnes, and J. Ryals. 1988. Isolation and nucleotide sequence of a novel cDNA clone encoding the major form of pathogenesis-related protein R. *Plant Molecular Biology* 11:223-224.
14. Métraux, J.P., W. Burkhardt, M. Moyer, S. Dincher, W. Middlesteadt, S. Williams, N. Desai, T.D. Parks, S. Dincher, M. Carnes, and J. Ryals. 1989. Isolation of a complementary DNA encoding a chitinase with structural homology to a bifunctional lysozyme/chitinase. *Proc. Natl. Acad. Sci. USA* 86:896-900.
15. Payne, G., W. Middlesteadt, N. Desai, S. Williams, S. Dincher, M. Carnes, and J. Ryals. 1989. Isolation and sequence of a genomic clone encoding the basic form of pathogenesis-related protein 1 from *Nicotiana tabacum*. *Plant Molecular Biology* 12:595-596.
16. Payne, G., P. Ahl, M. Moyer, A. Harper, J. Beck, F. Meins, and J. Ryals. 1990. Isolation of complementary DNA clones encoding pathogenesis-related proteins-P and -Q, two acidic chitinases from tobacco. *Proc. Natl. Acad. Sci. USA* 87:98-102.
17. Shinshi, H., J.-M. Neuhaus, J. Ryals and F. Meins, Jr.. 1990. Structure of a tobacco endochitinase gene. *Plant Molecular Biology* 14:357-368.
18. Métraux, J.P., H. Signer, J. Ryals, E. Ward M. Wyss-Benz, J. Guadin, K. Raschdorf, E. Schmid, W. Blum, and B. Inverardi. 1990. Increase in salicylic acid at the onset of systemic acquired resistance. *Science* 250:1004-1006.
19. Payne, G., E. Ward., T. Gaffney, P. Ahl Goy, M. Moyer, A. Harper, F. Meins Jr., and J. Ryals. 1990. Evidence for a third structural class of B-1,3-glucanase in tobacco. *Plant Molecular Biology* 15:797-808.
20. Sperisen, C., J. Ryals, and F. Meins, Jr. 1991. Comparison of cloned genes provides evidence for intergenomic exchange of DNA in the evolution of a tobacco β -1,3-glucanase gene family. *Proc. Natl. Acad. Sci. USA* 88:1820-1824.

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21. Ward, E., G. Payne, M. Moyer, S. Williams, S. Dincher, K. Sharkey, J. Beck, H. Taylor, P. Ahl Goy, F. Meins, Jr., and J. Ryals. 1991. Differential regulation of β -1,3-glucanase mRNAs in response to pathogen infection. *Plant Physiol.* 96:390-397.
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26. Ward, E., Uknes S., Williams, S., Dincher S., Wiederhold, D., Alexander D. Ahl-Goy, P. Métraux, J.P. and J. Ryals, 1991. Coordinate induction of gene expression in response to agents that induce systemic acquired resistance in tobacco. *The Plant Cell* 3:1085-1094.
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40. Uknes, S., Lawton, K., Ward, E., Gaffney, T., Friedrich, L., Alexander, D., Goodman, R., Métraux, J.P., Kessmann, H., Ahl-Goy, P., Gut-Rella, M. and J. Ryals. 1993. The molecular biology of systemic acquired resistance. In: *Plant Response to the Environment. Current Topics of Plant Molecular Biology*. 2:1-10. P.M. Gresshoff, ed. CRC Press. Boca Raton.
41. Uknes, S., Dincher, S., Friedrich, L., Negrotto, D., Williams, S., Taylor, H., Potter, S., Ward, E. and J. Ryals. 1993. Regulation of pathogenesis-related protein-1a gene expression in tobacco. *The Plant Cell* 5:159-169.
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47. Gaffney, T., Friedrich, L., Vernooij, B., Negrotto, D., Nye, G., Uknes, S., Ward, E., Kessmann, H., Ryals, J. 1993. Requirement of salicylic acid for the induction of systemic acquired resistance. *Science* 261:754-756.
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49. Potter, S., Uknes, S., Lawton, K., Winter, A., Ward, E., Ryals, J. 1993. Regulation of a hevein-like gene in *Arabidopsis*. *Molecular Plant-Microbe Interactions* 6:692-698.
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53. Lawton, K., Vernooij, B., Friedrich, L., Alexander, D., Métraux, J.P., Kessmann, H., Gut Rella, M., Uknes, S., Ward, E., Ryals, J., 1994. Signal transduction in systemic acquired resistance. In: *Current Topics in Plant Physiology. Plant signals in interactions with other organisms*. Volume 12. pp126-133. Schultz, J., Raskin, I. Eds. American Society of Plant Physiologists.
54. Ward, E., Uknes, S., Ryals, J. 1994. Molecular biology and genetic engineering to improve plant disease resistance. In: *Molecular Perspectives in Crop Protection*. Walters, D., Marshall, G., eds. Chapman and Hall, London. pp 121-145.
55. Tada, S., Volrath, S., Guyer, D., Scheidegger, A., Ryals, J., Ohta, D., Ward, E. 1994. Isolation and characterization of cDNAs encoding imidazoleglycerolphosphate dehydratase from *Arabidopsis thaliana* and *Triticum aestivum*. *Plant Physiology* 105:579-583.
56. Lawton, K., Potter, S., Uknes, S., Ryals, J. 1994. Systemic acquired resistance signal transduction *Arabidopsis* is ethylene independent. *The Plant Cell* 6:581-588.
57. Ryals, J., Uknes, S., Ward, E. 1994. Systemic acquired resistance. *Plant Physiology* 104: 1109-1112.
58. Vernooij, B., Uknes, S., Ward, E., Ryals, J. 1994. Salicylic acid as a signal molecule in plant pathogen interactions. *Current Opinions in Cell Biology* 6:275-279.
59. Brears, T., Ryals, J. Genetic engineering for disease resistance in plants. 1994. *Agro Food Industry Hi-Tech* 5:10-13.
60. Dietrich, R., Delaney, T., Uknes, S., Ward, E., Ryals, J., Dangl, J. 1994. *Arabidopsis* mutants simulating disease response. *Cell* 77:565-577.

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63. Meins, F., Fritig, B., Linthorst, H., Mikkelsen, J., Neuhaus, J-M., Ryals, J. 1994. Plant Chitinase Genes. *Plant Molecular Biology Reporter* 12:S22-S28.
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97. Glassbrook, N., Ryals, J. 2001. A systematic approach to biochemical profiling. *Current Opinion in Plant Biology*. 4:186-190.

98. Friedrich, L. Lawton, K., Dietrich, R., Willits, M., Cade, R., Ryals, J. 2001. NIM1 overexpression in Arabidopsis potentiates plant disease resistance and results in enhanced effectiveness on fungicides. *Molecular Plant-Microbe Interactions*. 14: 1114-1124.

99. Berenbaum, M., Brusseu, M., Dipietro, J., Goodman, R., Gould, F., Gunsolus, J., Hammock, B., Hartung, R., Marrone, P., Maxwell, B., Raffa, K., Ryals, J., Shaner, D., Sieber, J., Zilberman, D. The Future Role of Pesticides in US Agriculture. National Academy of Sciences, 2000.

100. Glassbrook, N., Beecher, C., Ryals, J. 2000. Metabolic profiling on the right path. *Nature Biotechnology*. 18: 1142-1143.

101. Molina, A., Bottoms, J., Kramer, C., Grolach, J., Frederiksen, R., Uknes, S., Ryals, J. Depletion of endogenous salicylic acid in maize by transgenic expression of the nahG gene does not alter the response to plant pathogenic fungi. Submitted to *Plant Cell* 2002.

102. Maleck, K., Neuenschwander, U., Cade, R.M., Dietrich, R.A., Dangl, J.L. and Ryals, J.A. 2002. Isolation and characterization of Broad-Spectrum Disease-Resistant Arabidopsis Mutants. *Genetics*. 160:1661-1671.

Invited Seminars:

1. "Identification of DNA sequences involved in the viral induction of human interferon-alpha. Symposium on the Introduction of Genes into Cells and Organisms. University of Oxford. Oxford, England. October 1-2, 1984.

2. "Regulation of human interferon-alpha gene expression". Genentech, Inc. South San Francisco, Ca. August, 1984.

3. "Regulation of human interferon-alpha gene expression". University of North Carolina. Department of Biology. October, 1985.

(Invited Seminars, cont'd.)

4. "Regulation of human interferon-alpha gene expression". Walter Reed Army Hospital Research Institute. Washington, DC. October, 1985.

5. "Regulation of human interferon-alpha gene expression". Sogetal, Inc. San Francisco, Ca. July, 1988.

6. "Regulation of human interferon-alpha gene expression". DOW, Inc. Midland, MI, March, 1988.

7. "Isolation of a novel chitinase cDNA from virus infected cucumber leaves". North Carolina Biotechnology Consortium. Plant Mol Biol-2nd Annual meeting-Beaufort, NC. Sept. 30, 1988.

8. "Toward the genetic engineering of disease resistant crops". Special Seminar-Plant Molecular Biology/Genetic Engineering for Agriculture. AAAS Annual Meeting. San Francisco, Ca. January 15-17, 1989,

9. "Toward the genetic engineering of disease resistant crops". Department of Crop Science. North Carolina State University. Raleigh, NC. January 26, 1989.

10. "Toward the genetic engineering of disease resistant crops". Department of Molecular Genetics. National Institutes of Health. Washington, DC. January 30, 1989.

11. "The molecular biology of systemic acquired resistance". Department of Plant Biology. The Salk Institute. San Diego, CA. April, 11, 1989.

12. "Toward the genetic engineering of disease resistant plants". Department of Biochemistry. Iowa State University. Ames, Iowa. May 1, 1989.

13. "The molecular biology of systemic acquired resistance in plants". Department of Botany. North Carolina State University. Raleigh, NC. Sept. 13, 1989.

14. "The molecular biology of systemic acquired resistance in plants". Fundacion Juan March. Workshop on pathogenesis-related proteins in plants. Valencia, Spain. October 25, 1989.

15. "The molecular biology of systemic acquired resistance in plants". Departamento de Bioquímica. E.T.S.I. Agronomos. University of Madrid. Madrid, Spain. October 27, 1989.

16. "The molecular biology of systemic acquired resistance in plants". Friedrich Miescher-Institut. Basle, Switzerland. October 30, 1989.

17. "Toward the genetic engineering of disease resistant crops". Progress in recombinant DNA

technology and applications. Engineering Foundation Conferences. Trout Lodge, Potosi, Mo. June 6, 1990.

18. "The molecular biology of systemic acquired resistance in plants". North Carolina Biotechnology Consortium. Plant Molecular Biology-Fourth Annual Meeting-Beaufort, NC. October 21, 1990.

19. "Toward the genetic engineering of disease resistant crops". Biotech USA. Washington, DC. November 27, 1990.

20. "The molecular biology of systemic acquired resistance in plants". University of California, Berkeley. Department of Plant Pathology. January 21, 1991.

(Invited Seminars, cont'd.)

21. "The molecular biology of systemic acquired resistance in plants". Agricultural Sciences. Gordon Research Conference. Oxnard, California. January 29, 1991.

22. "Applications of the polymerase chain reaction to plant breeding" McKnight Foundation Seminar. Departments of Genetics and Crop Sciences. North Carolina State University. Raleigh, NC. February 25, 1991.

23. "Systemic acquired resistance: an inducible defense mechanism in plants". Society for Experimental Botany Symposium. Birmingham, England. April 19, 1991.

24. "The molecular biology of systemic acquired resistance in plants". Botany Department. Duke University. Durham, North Carolina. April 19, 1991.

25. "Systemic acquired resistance: an inducible defense mechanism in plants". Southeastern Regional Developmental Biology Meeting. Chapel Hill, North Carolina. May 8, 1991.

26. "Systemic acquired resistance: an inducible defense mechanism in plants" Friedrich Miescher-Institut. Basel, Switzerland. May 21, 1991.

27. "The molecular biology of systemic acquired resistance in plants". Institut für Genbiologische. Free University of Berlin. Berlin, Germany. May 24, 1991.

28. "Systemic acquired resistance as a source for disease tolerance genes". EUCARPIA Symposium on Genetic Manipulation in Plant Breeding. Salou, Spain. May 29, 1991.

29. "The molecular biology of systemic acquired resistance in plants". Institut für Pflanzenbiologie. Cytologie. Universität Zurich. May 31, 1991.

30. "The molecular biology of systemic acquired resistance in plants". Keynote Address. Annual Meeting for the NSF center for Engineering Plants Resistant Against Pathogens. October 25, 1991. Granlibakken, Lake Tahoe, California.

31. "Toward the genetic engineering of disease resistant crops". American Society of Agronomy/Crop Science Society of America/Soil Science Society of America. 1991 Annual Meeting. Denver, Colorado. October 28, 1991.

32. "The molecular biology of systemic acquired resistance in plants". Scripps Research Institute. San Diego, California. January 29, 1992.

33. "An alternative strategy for expressing insecticidal proteins in transgenic plants". Gordon Research Conference: Plant Herbivore Interactions. Oxnard, California. January 31, 1992.

34. "The molecular biology of systemic acquired resistance in plants". Keystone Symposium. Crop Improvement via Biotechnology: An International Perspective. April 10-16, 1992. Keystone, CO.
35. "The molecular biology of systemic acquired resistance in plants". Oregon State University. Center for Gene Research. May 11, 1992. Corvallis, OR.
36. "The molecular biology of systemic acquired resistance in plants". Third Gatlinburg Symposium. Plant Responses to the Environment. June 7-10, 1992. Knoxville, TN.
37. "The molecular biology of systemic acquired resistance in plants". Molecular Crop Agriculture for the Pacific Rim. June 20-24, 1992. Sacramento, CA.
(Invited seminars, cont'd.)
38. "The molecular biology of systemic acquired resistance in plants". Third International Workshop on Pathogenesis-Related Proteins in Plants. August 16-20, 1992. Arolla, Switzerland.
39. "The molecular biology of systemic acquired resistance in plants". Second European Foundation for Plant Pathology Meeting: Mechanism of Plant Defence Responses. August 24-27, 1992, Strasbourg, France.
40. "The molecular biology of systemic acquired resistance in plants". Friedrich Miescher-Institut. August 10, 1992. Basel, Switzerland.
41. "The role of salicylic acid in systemic acquired resistance". Botany Department. Duke University. November 6, 1992.
42. "Toward the genetic engineering of fungal resistant crops". Workshop on Engineering Plants Against Pests and Pathogens. Fundacion Juan March. January 11-13, 1993. Madrid, Spain.
43. "The molecular biology of systemic acquired resistance in plants". Institute of Genetics. Biological Research Center. Hungarian Academy of Sciences. January 15, 1993. Szeged, Hungary.
44. "The molecular biology of systemic acquired resistance in plants". Department of Botany and Plant Pathology. Purdue University. February 17, 1993. West Lafayette, Indiana.
45. Panel Discussion. New Technologies. "Agriculture in a sustainable global environment". 6th Biennial Nusbaum Symposium. Department of Plant Pathology. North Carolina State University. April 5, 1993. Raleigh, North Carolina.
46. "Biocontrol and plant responses to attack". 3rd International Conference on Biotechnology of Microbial Products. Society of Industrial Microbiology. April 20, 1993. Rohnert Park, California.
47. "The molecular biology of systemic acquired resistance". Plant Research Laboratory. Department of Energy. Michigan State University. April 28, 1993. East Lansing, Michigan.
48. "The molecular biology of systemic acquired resistance". Department of Vegetable Crops. University of California. May 7, 1993. Davis, California.
49. "Molecular responses in systemic acquired resistance". Eighth Annual Penn State Symposium in Plant Physiology. Plant Signals in Interactions with Other Organism. May 20-

22, 1993. State College, PA.

50. "Molecular responses in systemic acquired resistance". The Salk Institute. San Diego, Ca. June 7, 1993.

51. "The molecular biology of systemic acquired resistance". 1993 Congress on Cell and Tissue Culture. San Diego, Ca. June 8, 1993.

52. "Molecular responses in systemic acquired resistance". 1993 Gordon Conference on Plant Cell and Tissue Culture. Wolfboro, New Hampshire. June 17, 1993.

53. "The molecular biology of systemic acquired resistance". 6th International Congress on Plant Pathology. Montreal, Canada. August 5, 1993.
(Invited seminars, cont'd.)

54. "Acquired resistance as a source for disease tolerance genes". Food Production, Jobs, Biotechnology and the Future of Agriculture. American Chemical Society 1993 Annual Meeting. Chicago, IL. August 24-26, 1993.

55. "The molecular biology of systemic acquired resistance". The Sainsbury Laboratory. John Innes Institute. Norwich, UK. September 7, 1993.

56. "The molecular biology of systemic acquired resistance". Friedrich Miescher-Institute Annual Retreat. Engelberg Switzerland. September 11, 1993.

57. "Signaling in systemic acquired resistance". Annual Retreat for the Department of Plant Pathology. Cornell University. September 30, 1993.

58. "Signaling in systemic acquired resistance". American Society of Plant Pathology Annual Meeting. Nashville, Tenn., November 8, 1993.

59. "The molecular biology of systemic acquired resistance". Keystone Conference "Improved Crop and Plant Products Through Biotechnology". Keystone, Co. January 10, 1994.

60. "The molecular biology of systemic acquired resistance". Department of Crop Science. North Carolina State University. February 3, 1994.

61. "The molecular biology of systemic acquired resistance". Plant Gene Expression Center. USDA. Albany, California. February 28, 1994.

62. "The molecular biology of systemic acquired resistance". The Noble Foundation. Ardmore Oklahoma. March 1, 1994.

63. "The molecular biology of systemic acquired resistance". Plant Genetics Program. University of Guelph. Guelph, Ontario, Canada. March 4, 1994.

64. "Acquired resistance in Arabidopsis: A genetic approach-the limitations". Banbury Conference on The Arabidopsis Genome. The Banbury Center. Cold Spring Harbor Laboratory. New York. March 20-23, 1994.

65. "An overview of the current state of plant biotechnology". Plant Biotechnology Foresight Workshop. Trinity College, Cambridge, England. March 29, 1994.

66. "The molecular biology of systemic acquired resistance". Department of Plant Pathology. University of Florida, Gainesville, Florida. April 11, 1994.

67. "The molecular biology of systemic acquired resistance". The University of Arizona. Department of Plant Pathology. Tuscon, Arizona. May 2, 1994.
68. "The molecular biology of systemic acquired resistance". Oregon State University. Corvallis, Oregon. May 5, 1994.
69. "The molecular biology of systemic acquired resistance". University of Chicago. Chicago, Illinois. May 6, 1994.
70. "The molecular biology of systemic acquired resistance". American Society of Microbiology. Las Vegas, Nevada. May 26, 1994.

(Invited seminars, cont'd.)

71. "The molecular biology of systemic acquired resistance". International Society of Molecular Plant-Microbe Interactions. Edinburgh, Scotland. June 29, 1994.
72. "Signal transduction in systemic acquired resistance". National Academy of Sciences Colloquium. Self-defense by plants: Induction and signal pathways. September 15-17, 1994. Irvine, California.
73. "Signal transduction in systemic acquired resistance". The 11th John Innes Symposium. September 19-22, 1994. Norwich, UK.
74. "Signal transduction in systemic acquired resistance". 38th Annual conference Australia Biochemistry Society. September 26-29, 1994. Gold Coast, Australia.
75. "Signal transduction in systemic acquired resistance". Department of Plant Pathology, University of Wisconsin. October 20, 1994. Madison, Wisconsin.
76. "Signal transduction in systemic acquired resistance". Department of Botany. University of Georgia. January 30, 1995. Athens, Georgia.
77. "Signal transduction in systemic acquired resistance". Gordon Research Conference. Agricultural Sciences. February 5-10, 1995. Casa Sirena, California.
78. "Signal transduction in systemic acquired resistance". Keystone Symposium. Host-Fungus Pathogenic Interactions. February 25 – March 3, 1995. Taos, New Mexico.
79. "Signal transduction in systemic acquired resistance". Keystone Symposium. Signal Transduction in Plants. March 29 - April 4, 1995. Hilton Head, South Carolina.
80. "Signal transduction in systemic acquired resistance". Banbury Center Conference. Molecular Biology of Disease Resistance Gene in Plants. Cold Spring Harbor Laboratory. New York.
81. "Signal transduction in systemic acquired resistance". Department of Biology. University of Massachusetts. May 4, 1995. Amherst, MA.
82. "Control of pests using transgenic plants". 95th General Meeting of the American Society for Microbiology. May 23, 1995. Washington, DC.
83. "Systemic acquired resistance as a strategy for disease control". 13th International Plant Protection Congress. July 3, 1995. Den Haag, The Netherlands.

84. "Systemic acquired resistance as a strategy for disease control". Sustainable Agriculture: Crop improvement and resource management. 65th Annual Gatlinburg Symposium. July 12 – 15, 1995. Knoxville, TN.
85. "Systemic acquired resistance as a strategy for disease control". 4th International Workshop on Pathogenesis-Related Proteins in Plants: Biology and Biotechnology Potential. September 3-7, 1995. Kloster Irsee, Germany.
86. "Advances in Agricultural Biotechnology". 1st Governor's Summit on North Carolina Agriculture. November 28, 1995. Raleigh, North Carolina.
87. "Signalling in Systemic Acquired Resistance". Department of Chemistry. Purdue University. January 16, 1996. West Lafayette, Indiana.
(Invited seminars, cont'd.)
88. "Signalling in Systemic Acquired Resistance". Department of Botany. University of Texas at Austin. January 18, 1996. Austin, Texas.
89. "Signal Transduction in systemic acquired resistance". Biotechnology Seminar Series. University of Nebraska. Lincoln, Nebraska. January 31, 1996.
90. "Systemic acquired resistance as a basis for crop disease control". IBC World Summit on Agricultural Biotechnology. March 4-5, 1996. Santa Fe, New Mexico.
91. "Signalling in systemic acquired resistance". Department of Plant Pathology. The Ohio State University. February 20, 1996. Columbus, Ohio.
92. "Systemic acquired disease resistance in plants". American Chemical Society Meeting. March 25, 1996. New Orleans, Louisiana.
93. "Signal transduction in systemic acquired resistance". Department of Molecular and Cellular Biology. The University of Texas at Dallas. March 27, 1996. Richardson, Texas.
94. "Biotechnology products arising from an understanding of molecular plant-microbe interactions". 8th International Congress Molecular Plant-Microbe Interactions. July 14-19, 1996. Knoxville, Tennessee.
95. "Signal transduction in systemic acquired resistance". Plant Molecular Biology Gordon Conference. July 21-25, 1996. New Hampton, New Hampshire.
96. "Signal transduction in systemic acquired resistance". Graduate Student Seminar. Plant Molecular Biology Program. University of California at Davis. September 24, 1996. Davis, California.
97. "Signal transduction in systemic acquired resistance". Graduate Student Seminar. Department of Plant Pathology. Kansas State University. October 28, 1996. Manhattan, Kansas.
98. "Biotechnology products emerging from an understanding of plant-microbe interactions". Gordon Research Conference. Agricultural Science. Design and Discovery in Crop Protection. February 9-14, 1997. Ventura, CA.
99. "Signal transduction in systemic acquired resistance in plants". UCLA Biotechnology Forum. UCLA Training Program in Biotechnology. University of California at Los Angeles. February 18, 1997. Los Angeles, CA.

100. "Signal transduction in systemic acquired resistance in plants". Program in Plant Molecular Biology and Biotechnology. Ohio State University. April 9, 1997. Columbus, OH.
101. "Signal transduction in systemic acquired resistance. Laboratory of Plant Molecular Biology. The Rockefeller University. October 9, 1997. New York, New York.
102. "The molecular biology of plant disease resistance" 30th Anniversary of the Institute of Molecular Biology, University of Zurich. October 15, 1998. Zurich, Switzerland.
103. "Defense mechanisms of plants". 1998 AAAS Annual Meeting. February 15, 1998. Philadelphia, PA.
104. "Signal transduction in systemic acquired resistance". 2nd Joint US-Mexico Symposium on Plant Biochemistry and Molecular Biology. March 17, 1998. Guanajuato, Mexico.
105. "Genomics in Plant Breeding" Seminis Annual Breeders Workshop. April 28, 1998. Cancun, Mexico.
106. "Signal transduction in systemic acquired resistance". Biology Department Retreat, University of Pennsylvania. Philadelphia, PA. May 10, 1998.
107. "Genomic approaches to gene discovery". Society for In Vitro Biology. Las Vegas, NV. June 2, 1998.
108. Co-Convener. Molecular Approaches to Optimizing Pesticide Discovery and Use. 9th International Congress. Pesticide Chemistry. IUPAC. London, UK. August 4, 1998.
109. "Systemic acquired resistance signal transduction". 7th International Congress of Plant Pathology. Edinburgh, Scotland. August 13, 1998.
110. "The post-industrialized agricultural biotechnology era: what's rate limiting?" National Academy of Sciences Colloquium. December 6, 1998
111. "Identification of targets for herbicides and fungicides by a genomics based strategy." Gordon Conference, Ventura, California. February 15, 1999.
112. "Agricultural Biotechnology: the next ten years". Fourth Int'l. course on the structure, function and manipulation of the plant genome. Irapuato, Mexico. March 8, 1999.
113. "A functional genomics approach to understanding gene function in plants". Fourth Int'l. course on the structure, function and manipulation of the plant genome. Irapuato, Mexico. March 9, 1999.
112. "Making a state strong in biotechnology: the experience and evidence of North Carolina." BioGenTec NRW Int'l. Biotechnology Meeting, Koln, Germany. March 15, 1999.
113. "The molecular biology of systemic acquired resistance in plants." Texas A & M University, College Station, Texas. April 14, 1999.
114. "Use of genomics in agbio technology". North Carolina State University, Raleigh, North Carolina. May 5, 1999.
115. "Chemical signaling in systemic induced resistance (SAR)." The 8th US-Japan Seminar, Marina del Rey, California. June 20, 1999

116. "Local and systemic resistance." 9th Int'l. Congress of Molecular Plant-Microbe Interactions." Amsterdam. July 28, 1999.
117. "High-throughput genomics for crop protection chemical discovery." 54th Corn and Sorghum Research Conference. Chicago, Illinois. December 10, 1999.
111. "The case for private ownership: Corporate or joint development and private ownership." Second Annual National Symposium on the Future of American Agriculture, University of Georgia, Athens, Georgia. August 10, 2000.
112. "Agricultural genomics: The industrialization of biology". The World Congress on Biotechnology, Berlin, Germany. September 7, 2000.
113. "Applied and Functional Genomics." Annual Genomics Conference, San Francisco, California. September 26, 2000.
114. "New Technologies/Genomics: What does it really mean to Agrifood?" The AgBio CEO Meeting, Dana Point, California. October 13, 2000.
115. "Dynamic changes in the Biotech industry." North Carolina State University Graduate Symposium, Raleigh, North Carolina. November 2, 2000.
116. "The industrialization of genomics." Harvard Business School, Boston, Massachusetts. January 7, 2001.
117. "The agricultural genomics: The industrialization of biology." Keystone Symposia, Big Sky, Montana. January 29, 2001.
118. "Genomics and herbicide target sites". Gordon Conference, Boston, Massachusetts. February 12, 2001.

Issued Patents:

1. EPO 0353191 B1 DNA sequences encoding polypeptide having B – 1.3 glucanase activity.
2. US Patent #5,290,926. Isolated DNA encoding plant histidinol dehydrogenase. March 1, 1994.
3. US Patent #5,348,743. Anti-pathogenic effective compositions comprising lytic peptides and hydrolytic enzymes. September 20, 1994.
4. US Patent #5,614, 395. Chemically regulatable and antipathogenic DNA sequences and uses thereof. March 25, 1997.
5. US Patent # 5,631,007. Anti-Pathogenically effective compositions effecting compositions comprising lytic peptides and hydrolytic enzymes. May 20, 1997.
6. US Patent #5,639,949. Genes for the synthesis of antipathogenic substances. June 17, 1997.
7. US Patent #5,643,774 Genes for the synthesis of antipathogenic substances. July 1, 1997.
8. US Patent #5,650,505. Chemically Regulatable and Anti-Pathogenic DNA Sequences and Uses Thereof. July 22, 1997.

9. US Patent #5,654,414. Chemically inducible promoter of a cucumber chitinase.lysozyme gene. August 5, 1997.
10. US Patent #5,662,898. Genes for the synthesis of antipahtogenic substances. September 2, 1997.
11. US Patent #5,689,044. Chemically inducible promoter of a plant PR-1 gene. November 18, 1997.
12. US Patent #5,698,425. Method of protecting plants by transformation with genes for the synthesis of antipathogenic substances. December 16, 1997.
13. US Patent #5,716,849. Genes for the biosynthesis of soraphen. February 10, 1998.
14. US Patent #5,723,759. PyrrolNitrin biosynthesis genes. March 3, 1998.
15. US Patent #5,767,369. DNA sequences encoding SAR8.2 proteins and uses thereof. June 16, 1998.
16. US Patent #5,777,200. Chemically regulatable and anti-pathogenic DNA Sequences and uses thereof. July 7, 1998
17. US Patent #5,789,214. Method of inducing gene transcription in a plant. August 4, 1998.
18. US Patent #5,792,904. Method for breeding disease resistance into plants. August 11, 1998.
19. US Patent #5,804,693. Chemically regulatable and anti-pathogenic DNA sequences and uses thereof. September 8, 1998.
20. US Patent #5,847,258. DNA encoding beta 1,3 glucanases. December 8, 1998.
21. US Patent #5,851,766. Process for isolating chemically regulatable DNA sequences. December 22, 1998.
22. US Patent #5,856,154. Method of protecting plants from oomycete pathogens. January 5, 1999.
23. US Patent #5,880,328. DNA encoding plant chitinases. March 9, 1999.
24. US Patent #5,942,662. Inducible Herbicide Resistance. August 24, 1999.
25. US Patent #5,986,082. Altered forms of the Nim1 gene conferring disesae resistance in plants. November 16, 1999.
26. US Patent #6,031,153. Method for protecting plants. February 29, 2000.
27. US Patent #6,054,637. Signal sequences for vacuolar sorting. April 25, 2000.
28. US Patent #6,057,490. Method for selecting disease resistant mutant plants. May 2, 2000.
29. U. S. Patent #6,091,004. Gene encoding a protein involved in the signal transduction cascade leading to systemic acquired resistance in plants. July 18, 2000.
30. U. S. Patent #6,107,544. Method for breeding disease control into plants. August 22, 2000.

31. U. S. Patent #6,232,525. Mutant plants and uses therefor. May 15, 2001.
32. U. S. Patent #6,262,342, DNA Sequences Enclosing Polypeptides Having .Beta.-1,3-Glucanase Activity. July 17, 2001.

Patent Applications: Inventor on 22 other applications being prosecuted worldwide.

Professional Activities/Associations:

1. Member-External Scientific Advisory Board. National Science Foundation-Center for Engineering Plants Resistant Against Pathogens (CEPRAP), Davis, California. 1990 to 1998.
2. Panel Member, USDA Competitive Grants Study Section. Pathogens/Weeds Program. 1992.
3. Panel Member, USDA Competitive Grants Study Section. Pathogens/Weeds Program. 1993.
4. Member-International Society for Plant Molecular Biology.
5. Member-American Association for the Advancement of Science.
6. Member-American Society of Plant Physiologist.
7. Reviewed manuscripts in the following journals:

Nature	Proc. Natl. Acad. Sci.	Plant Physiology
Science	The Plant Cell	Gene
Bio/Technology	The Plant Journal	Trends in Microbiol.
J. of Biol. Chem.	Maydica	Plant Molecular Biology
Molecular Plant Microbe Interactions		Plant Cell and Environment
Netherlands Journal of Plant Pathology		Transgenic Research
Biochimica et biophysica Acta		
8. Ad hoc reviewer for research proposals from the following agencies:
 - National Science Foundation-US
 - USDA-Competitive Grants Program
 - Nationalfonds of Switzerland
 - National Science and Engineering Research Council of Canada
 - Binational Agricultural Research and Development Fund (BARD).
 - Department of Energy
 - German-Israeli Foundation (GIF)
9. Editorial Board. *Molecular Breeding*. 1995 to present.
10. Editorial Board. *Plant-Microbe Interactions*. (Book series). 1995 to 1999.
11. Associate Editor. *Plant Physiology*. 1994. Monitoring Editor 1995 to 1997.
12. International Program Advisory Group. 7th International Symposium on Molecular Plant-Microbe Interactions. Edinburg, Scotland. June 26-July 1, 1994.
13. Scientific Advisory Board. Center for Legume Research, University of Tennessee and The Gatlinburg Symposium Series on Plant Science. 1995 to 2000.
14. Adjunct Professor. Department of Crop Science. North Carolina State University. June 1995 to December 2005.

15. Invited lectures on "Plant responses to pathogens" for "Plant Biochemistry 1994" course at Michigan State University. July 16, 1994.
16. International Advisory Board. 8th International Symposium on Molecular Plant-Microbe Interactions. Knoxville, Tennessee. 1996.
17. Co-investigator (with 16 others). Dept of Education/NSF/USDA Interdisciplinary Research Training Group in the Molecular Biology of Transgenic Plants. 1994-1998.
18. Advisory Board. *The Plant Journal*. January, 1995 to December, 1999.
19. Senior Editor. *Molecular Plant-Microbe Interactions*. January, 1995-1997.
20. Panel Member, USDA Competitive Grants Study Section. Genetic Mechanisms Program. 1995.
21. Board of Trustees of The Friedrich-Miescher Institute, Basel, Switzerland. 1996 to 1997.
22. External Advisory Council. Center for Biotechnology. University of Nebraska. 1996 to 2000.
23. Member of the National Academy of Sciences Committee on the Future Role of Pesticides in US Agriculture.
24. Senior Editor. *Molecular Plant Pathology*. 1999 to 2003
25. January, 2000. Member, Executive Committee, Vice Chair of Food & Agricultural Governing Body, and Member of Board of Directors of Biotechnology Industry Organization (BIO).
26. Chairman, Board of Directors, Athenix, Inc. June 2001 to January, 2004, Board Member January, 2004 to January, 2006. Consultant January, 2006 to present.
27. Member, Board of Directors, NCSU Physical and Mathematical Sciences Foundation. 2001 to present.
28. Editor of Faculty of 1000, January, 2001 to present.
29. Member of Life Sciences Board for Aurora LLP
30. Member Science Advisory Board for Trelys Funds

Awards:

1. Ciba Fellow. Awarded October 28, 1993. Recognition for advances in understanding plant-pathogen interactions. (There were 10 CIBA Fellows out of 95,000 worldwide employees. This is the highest award/acknowledgement for a scientist within the company).
2. Co-recipient of the 1994 Agrinova Award from Ciba-Geigy Agricultural Division for innovation in agriculture. This award was given for the development of a transgenic plant-based high-throughput chemical screen for induced resistance compounds capable of screening over 100,000 compounds per year.
3. Nominee, Entrepreneur of the Year 2000, Ernest & Young.

4. Most highly cited author

5. Named by PharmaVoice as one of the top 100 most Inspiring People in the Pharmaceutical Industry. (August, 2005)